

Industry Certification Program in Project Management

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Abstract

Engineering Technology curricula generally provide wide spread knowledge in problem solving, management of resources, and process planning. Project Management is a key skill required by Engineering Technologists, who work in project-driven manufacturing companies. An Industry Advisory Council for a university in Louisiana expressed the need for project management trained graduates, and worked with Engineering Technology faculty to develop a post-baccalaureate certificate program focused on technical project management. In addition, the Industry Advisory Council worked closely with Engineering Technology faculty to develop a new course on “Technical Project Management” that can combine with other courses offered by the department and college to prepare project management certificate graduates.

This paper discusses the development of a post-baccalaureate industry certificate program on project management. It starts by identifying the need for project management knowledge and skills. After that it discusses the key components for project management body of knowledge as identified by the Project Management Institute. These components led to identifying relevant course topics to include: Introduction to Project Management, Engineering Economic Analysis, Project Selection, Project Organization, Project Scheduling, Resource Management, and Project Control. These topics were used to evaluate university curricula to identify what existing courses can be used to deliver the required knowledge and skills. Evaluating existing curricula resulted in identifying the need for a new course on “Technical Project Management”. Furthermore, the developed certificate will be offered both face-to-face and online, hence the paper discusses adaptations of content to facilitate delivery in these different environments. The paper concludes by providing directions for future development of the certificate.

Introduction and Background

The National Academy of Engineering forecasts that engineers and technologists will continue to operate in a rapidly changing innovation environment¹. This is compounded by globalization of economies, diversity of social and business groups, multidisciplinary research trends, and cultural and political forces. Engineering systems are of increasing complexity in energy, environment, food, product development, and communications¹. Hence, it is imperative to introduce engineering and technology practices in undergraduate education, where students can experience the iterative process of designing, analyzing, building and testing. There is a growing importance for engineering practice, but the engineering profession seems to be held in low regard compared to other professions and industry tends to view engineers and technologists as disposable commodities².

Engineering Technology prepares graduates with knowledge skills and technical problem solving abilities necessary to success in a wide range of engineering technology disciplines³. The specific ABET ETAC student outcomes for Engineering Technology are⁴:

- a. An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities

- b. An ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies
- c. An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes
- d. An ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives
- e. An ability to function effectively as a member or leader on a technical team
- f. An ability to identify, analyze, and solve broadly-defined engineering technology problems
- g. An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature
- h. An understanding of the need for and an ability to engage in self-directed continuing professional development
- i. An understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
- j. A knowledge of the impact of engineering technology solutions in a societal and global context
- k. A commitment to quality, timeliness, and continuous improvement

The field of manufacturing is wide, and engineering technologists must understand the processes and materials involved in the creation of a useful product⁵. The emergence of non-traditional education providers (such as online and hybrid) poses challenges for US higher education institutions. To remain competitive, US universities should re-adapt the way education is delivered, and develop curricula that meets the core competencies required in the market place⁶. At a time when local, state, and national resources for education are becoming increasingly scarce, expectations for institutional accountability and student performance are becoming more demanding. There is a need for more educational innovations that have a significant impact on student learning and performance⁷.

A manufacturing managers association approached an engineering technology department at a university in Louisiana with a need to develop a new program tailored to working professionals. This program was named a Post- Baccalaureate Certificate in Project Management program, which focuses on effective decision-making in technical, manufacturing, and service providing industries. According to long term projections for industrial production managers, the need for managers in industrial situations is 2170/year until 2022. In the Louisiana Workforce Commission's Five-Star Jobs listing, there are approximately 300 advertisements for supervisors, inspectors, controller, and industrial technician advertisements⁸ (accessed on 7/14/2015). With this new certificate program, it is expected that students with baccalaureate degrees will fill a number of project management related skilled personnel positions, controller and other supervisory positions in technical, manufacturing, and service providing industries in the State.

This research takes a pragmatic approach to develop a post- baccalaureate certificate. The paper proceeds by discussing the method used to carry out the research. After that it provides a summary of the results. The paper concludes by a discussion of the key findings and provide directions for future development of the certificate.

Method

This paper uses a case-study approach. Based on needs identified by a manufacturer manager council, a faculty team of the Engineering Technology department worked with members of their industry advisory committee to develop a new certificate program on project management. The team researched similar programs available nationwide, studied the body of knowledge provided by the Project Management Institute, and reviewed the university documentation and catalog information (including course descriptions and dependencies, course syllabi, course competencies, and course assignments). The team identified the knowledge areas required by a holder of the new certificate. The analysis revealed the need to add a new course on “Technical Project Management”. The department faculty then worked with the industry advisory group and the institution curriculum review committee to establish the new course. After that a new program proposal was submitted and approved by the institute’s governing body.

Results and Discussion

The selected Engineering Technology program has both major and support courses to prepare graduates for technical and supervisory careers in a variety of industries. The program combines technical knowledge with communications skills and teamwork to provide the flexibility needed in today’s rapidly changing marketplace. The selected program educational objectives are:

- Demonstrate technical proficiency in the field
- Apply quantitative reasoning and critical thinking in solving technical problems
- Effectively communicate technical knowledge, ideas, and proposals to others, including upper management
- Lead project teams in successful completion of projects
- Have strong organizational and management skills

The Project Management Institute defines project management as “the application of knowledge, skills, tools, and techniques to project activities to meet project requirements⁹”. To do so, project managers need to be proficient in managing the various project stages¹⁰:

- 1) Initiating
- 2) Planning
- 3) Executing
- 4) Monitoring/Controlling
- 5) Close-out

Several institutions nationwide provide certification programs in project management. Table 1 provides examples of such programs offered by Texas A&M University, University of Central Florida, and University of Maryland. Almost all university offering such a certificate program have 1-2 courses dedicated to the topic area of “project management” or “project engineering”.

Table 1. Examples of Project Management Certificate Programs

Program Title	Engineering Project Management	Project Engineering Certificate	Project Management Certificate
Offered by	Texas A&M University	University of Central Florida	University of Maryland
Core Courses	<ol style="list-style-type: none"> 1) Project Mgmt for Engineers or Civil Engineering Project Mgmt (3 credit hours) 2) Survey of Management (3 credit hours) 	<ol style="list-style-type: none"> 1) The Environment of Technical Organizations (3 credit hours) 2) Management Information Systems (3 credit hours) 3) Project Engineering (3 credit hours) 	<ol style="list-style-type: none"> 1) Project Cost Accounting and Finance (3 credit hours) 2) Introduction to Project Management (3 credit hours) 3) Management of Project Teams (3 credit hours)
Elective Courses	<p>Select 2 courses (6 credit hours):</p> <p>Technical Electives (1-2 courses)</p> <ol style="list-style-type: none"> 1) Managing Construction Projects and Project Risks (3 credit hours) 2) Engineering Project Estimating and Planning (3 credit hours) 3) Software Engineering (3 credit hours) 4) Engineering Software Projects (3 credit hours) 5) Engineering Economic Analysis (3 credit hours) 6) Engineering Management Techniques (3 credit hours) 7) Petroleum Project Evaluation (3 credit hours) <p>Business Electives (0-1 courses)</p> <ol style="list-style-type: none"> 1) Managing Organizational Behavior (3 credit hours) 2) Managing Human Resources (3 credit hours) 3) Organizational Design, Change and Development (3 credit hours) 4) International Management (3 credit hours) 5) Managing Projects (3 credit hours) 6) Small Business Management and Growth (3 credit hours) 	<p>Select 1 course (3 credit hours):</p> <ol style="list-style-type: none"> 1) Advanced Engineering Economic Analysis 2) Decision Analysis 	<p>Select 1 course (3 credit hours)</p> <ol style="list-style-type: none"> 1) Legal Aspects of Engineering Design and Construction (3 credit hours) 2) Project Performance Measurement (3 credit hours)
Notes	UG Level, Civil Engineering Department	Graduate Level, Industrial Engineering Department	Graduate, Engineering

As a result, the selected engineering technology department developed a new course on technical project management that discusses the following topics:

Part 1: Project Development

- a. Basic Project Structure
- b. Initiating Process
- c. Planning Process

Part 2: Project Schedule Analysis

- a. Activity Definition
- b. Activity Sequencing
- c. Resource Estimating
- d. Activity Duration Estimating
- e. Schedule Development

Part 3: Project Cost Analysis

- a. Cost Estimating
- b. Budget Development

Part 4: Project Monitoring and Control

- a. Schedule and Cost Monitoring
- b. Schedule and Cost Control

The developed course was then combined with other courses offered by the department and the university to address the knowledge areas required by the Project Management Institute, and resulted in the development of the Post-Baccalaureate Certificate in Project Management.

The Post-Baccalaureate Certificate in Project Management is an 18-hour program, which will be delivered online and face to face. The number of hours for the certificate program was determined by the requirements established by the institute's governing body. The certificate will fulfill workforce needs which have grown as Louisiana has attracted many technical, manufacturing, and service providing industries over the past five years. The following is a listing of the required and elective courses required for the certificate program.

Required Courses (12 credit hours)

- Technical Project Management (New; 3 credit hours): Project evaluation and selection; project planning, organizing, managing and controlling. Software tools and techniques for work breakdown structure; project networks; scheduling; critical path method; program evaluation and review technique; project crashing for small/large project of commercial/academic or nonprofit organizations.
- Elements of Occupational Supervision (3 credit hours): Preparation, training, and problems of the supervisor.
- Engineering Economics (3 credit hours): Principles and applications of economic analysis presented through engineering-oriented examples. Introduction and definitions of economic factors, analysis methods for evaluating alternative choices, and decision making tools for real-world situations.

- Spreadsheet Applications (3 credit hours): This course is designed to assist students in preparing for the MOS (Microsoft Office Specialist) Excel Certification. Attention is given to developing skills in spreadsheet applications including data exchange between other types of applications.

Electives: (Take 2 electives, 6 credits hours)

- Production and Inventory Control (3 credit hours): Planning and control of production; operation analysis; routing, scheduling, dispatching; production charts and boards; inventory control; accumulation of material requirements; use of critical path techniques.
- Business Reports and Communications (3 credit hours): Communication problems, business letters, employment application procedures. Problem areas investigated by research procedures; sources of data, compilation and arrangement of data, documentation, bibliography, and effective presentation.
- Business Law I (3 credit hours): The study of the legal environment of Business, with an emphasis on the development of law, an overview of the court system, legal concepts underlying business crimes and torts, contracts, employer-employee relationships, commercial paper, and property rights, ethics.
- Organization and Management (3 credit hours): Management processes and ethics, with focus on the management of people in organizations, their behavior, motivation, and interactions with management structure.
- Quality Control (3 credit hours): Methods and procedures employed in industrial quality control, theories of measurement, error, prediction, sampling, tests of significance and models.
- Data Analytics (3 credit hours): This course provides an introduction to the field of data analytics, which can be defined as the extensive use of data, statistical and quantitative analysis, exploratory and predictive models, and fact-based management to drive decisions and actions. Data analytics is explored as a process of transforming data into actions through analysis and insights in the context of organizational decision making and problem solving. This course stresses the factors that impact the performance of business decision makers and the data management and analysis methods that add value to them. The application of selected data mining techniques to business decision making situations is illustrated. Students actively participate in the delivery of this course through case and project presentations.

Several of the identified courses are already offered both online and face-to-face by the university. Online course shells were developed for the courses that were only previously offered face-to-face. These course shells include assignments, online quizzes, and exams pursuant to the university's online policies.

The developed certificate program represents a way to address demands established by the market place. The future developments pertaining to the certificate include addition to university catalog and creation of recruiting materials. Proposals for additional certificate programs are in preparation for Quality Control, Automation and Robotics, and Business Analytics.

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